DOCUMENT RESUME

ED 463 109 RC 023 411

AUTHOR	Salyer, B. Keith; Curran, Christina; Thyfault, Alberta
TITLE	What Can I Use Tomorrow? Strategies for Accessible Math and Science Curriculum for Diverse Learners in Rural Schools.
PUB DATE	2002-03-00
NOTE	11p.; In: No Child Left Behind: The Vital Role of Rural Schools. Annual National Conference Proceedings of the American Council on Rural Special Education (ACRES) (22nd, Reno, NV, March 7-9, 2002); see RC 023 405.
PUB TYPE	Guides - Non-Classroom (055) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Assistive Devices (for Disabled); Classroom Environment; *Educational Strategies; Elementary Secondary Education; Grouping (Instructional Purposes); Integrated Curriculum; *Mathematics Instruction; Peer Teaching; *Regular and Special Education Relationship; Rural Education; *Science Instruction; Special Education; Teacher Collaboration; *Teaching Methods
IDENTIFIERS	*Content Area Teaching

ABSTRACT

Increased requirements for inclusion have created a growing demand for special educators to have content expertise in areas such as math and science. One recommended practice involves integrating the "big ideas" that are the foundation for understanding mathematics and science across the curriculum. Teachers also need to create a classroom climate that is supportive and content rich. Grouping students into pairs or triads supports student needs. Special educators can collaborate with other teachers by creating a bank of instructional activities on selected math and science topics. Collaborative strategies can be modeled through peer tutoring. Students should be encouraged to explore metacognitive thinking styles so they can apply metacognitive strategies to their daily lives. Skills outlined by standards should be presented in an order that makes sense to students in terms of context and cognitive organization. Nine steps are outlined for presenting content in an effective instructional sequence. Math and science textbooks require grade-level or above literacy skills. Many students, including those with disabilities, will benefit from study guides and outlines, graphic organizers, an introduction to key terms, audiotapes, and other assistive technology devices. Challenges to rural educators include inadequate resources and professional isolation. Advantages to rural educators include more cohesive groups of parents, teachers, and community members. Sidebars present practical tips and strategies for each topic discussed. (Contains 36 references). (TD)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 463 109

What Can I Use Tomorrow? Strategies for Accessible Math and Science Curriculum for Diverse Learners in Rural Schools

B. Keith Salyer, Christina Curran, and Alberta Thyfault

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

J. Weyrauch

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

RC 023 411

BEST COPY AVAILABLE

B. Keith Salyer, Ph.D.
salyerk@cwu.edu
Christina Curran, Ph.D.
curranc@cwu.edu
Alberta Thyfault, Ph.D.
thyfaulta@cwu.edu
Central Washington University
Teacher Education Programs
400 E. 8th Avenue
Ellensburg, WA 98926-7409

WHAT CAN I USE TOMORROW? STRATEGIES FOR ACCESSIBLE MATH AND SCIENCE CURRICULUM FOR DIVERSE LEARNERS IN RURAL SCHOOLS

A principal from a small rural district in central Oregon jokingly remarked at a northwest regional math conference that, "I wish that I could fill my building with special education teachers." For the most part teachers trained in special education methods have a deep understanding of students' needs and the learning process from which they are able to create a synergy of strengths. The ability of special education teachers to create effective learning environments is a major factor in the rising demands that are being placed on them within the profession. This paper will discuss the changing roles and responsibilities of special educators, strategies to support collaborative content delivery in math and science, and instructional and adaptation strategies special educators "can use tomorrow."

Roles and Responsibilities

The roles and responsibilities of the special educator are changing. A substantial increase in the number of students with disabilities receiving their education in general education classrooms has also occurred (U.S. Department of Education, 2000). This has resulted in a trend to utilize special education teachers as learning facilitators in inclusive classrooms (Friend & Cook, 2000). Indeed, these practices place new demands on teachers.

In years past the primary focus for the special education teacher has been as an expert in learning and in meeting student specific needs. Today the focus is still on how to best meet individual needs so learning can take place, however, there is also an increasing demand for content expertise in curriculum areas such as math and science. Moreover, current curriculum reform efforts in math and science recommend a different and more in-depth knowledge of content specific pedagogy, curricular standards, and strategies (Weiss, 1994; CBMS, 2001).

There is little doubt that the special educator must engage in an on-going balancing act requiring expertise in both learning and content. In some instances he/she will wear the "hat" of learning specialist, providing direct service and individualizing content and strategies for single or small groups of students. In other situations he/she will consult with the general educator to design and/or assist in the delivery of accommodations for the inclusive math or science classroom. Yet, another role the special educator might play would include that of collaborator, where general and special education teachers implement a type of team teaching strategy to deliver content in co-taught classrooms. In fact, it's not unusual for a special educator to wear multiple "hats."

The changing role of the special education teacher is only part of the impetus for broadening demands for content mastery. Educational accountability in the form of national and state standards based competency testing has dramatically rewritten the special education teacher's role (Kohn, 2000; Popham, 2000a; Popham 2000b; Elliot & Thurlow, 2000). Recent regulations in the Individuals with Disabilities Education Act require increased participation of students with disabilities in state or district-mandated accountability assessment systems. This requires that professionals ensure that all students, including those with disabilities, have access to the general education curriculum. Access to curriculum, however, isn't just about the "place" where content is delivered or even about the "people" adapting or delivering content. Several factors interact to impact the degree of success the learner has in inclusive math and science classrooms.

RC 023411

What Does it Take for Success?

Knowledge

Content Knowledge. Teachers must initially have a knowledge of current mathematics and science content, pedagogy and curriculum. This has changed drastically over the past decade as reform efforts have become infused into pedagogical training, curriculum materials and recommended instructional practices. The level and degree to which a special educator comes prepared to deliver, discuss and collaborate on content delivery in math and science varies widely. In science for instance, special educators receive little to no training in content pedagogy (Ormsbee & Finson, 2000; Polloway, Patton, & Serna, 2000).

One recommended pedagogical practice involves designing mathematics and science curriculum around "Big Ideas" (Kame'enui, Carnine, Dixon, Simmons, & Coyne, 2002). Simply put this involves infusing and interweaving ideas/concepts that are the foundation for understanding mathematics and science across lessons/units/materials. In mathematics this centers on interweaving the big ideas of concepts such as place value, expanded notation, mathematical properties, and equivalence across instructional topics/concepts. In science, this might include integrating concepts such as such as patterns, comparisons or discrepancies, impact or control of variables, and hypothesis testing across units of instruction. (Kame'enui, et. al, 2002). Big ideas assist learners in the generalization of mathematical and scientific concepts and learners move away from banks of isolated knowledge and facts.

Yet, knowledge and enthusiasm are simply not enough to ensure accessible math and science curricula. For inclusive educators this also includes: "... a) understanding the meanings, principles and process of a wide range of mathematics appropriate for the needs of students; b) recognizing unusual performance on the part of a student and how to adapt activities to determine the basis for this performance; and c) knowing the developing characteristics of the student in such detail that individualized curricula choices can be made as to when it is an appropriate time to present certain mathematics to a student, the sequence in which it should be presented, the intensity or length of time one should stay on topic to assure master, the mixture of mathematics that should be presented and how to determine if a students has attained proficiency and mastery of the principles" (Parmar & Cawley, 1998, p. 225).

Knowledge of classroom climate. The teacher is the major deciding factor in establishing the climate of the classroom and in making content accessible (Ginot, 1972). As the deciding factor, it is important that the teacher be well versed in establishing a classroom that meets the demands of content emergent learners. Although it is very important that the teacher be well versed in content, education must be focused on learning, which is a student-centered process.

Part of the paradigm shift from teaching content to teaching students requires an examination of the stressors within a learning environment. A certain amount of stress is healthy and productive in the learning process, but apply too much stress and the learning curve sharply decreases (Sherwood, 1965). When a student is over the optimum stress level the goal shifts from learning to survival. Teachers can do a lot in the organizational process to reduce stress for students. Teachers must create a classroom environment that is both supportive and content rich.

Establishing a climate that is student friendly and steeped in math and science content can be a challenge. Mathematics and science content textbooks are among the most difficult as they are characteristically different from the narrative materials of the other contents (Hollander, 1988). While experts underscore the importance of inquiry methods of math and science instruction, many educators still rely on textbooks for a substantial amount of instruction (Schumaker & Lenz, 1999; Schumm, 1999). Students must draw conclusions from the text and merge those inferences with the symbolic representation required to solve situations that are often foreign in concept, content, and nature. If a second grade student is posed the problem, "I bought three packages of pencils and each package has three pencils in it. How many pencils did I buy?" he/she will be able to answer. However, if you ask the same student to explain what 3^2 is, he/she will probably be unable to make sense of the symbolic representation. This is the battle teachers face when they rely on most textbooks (symbolic in nature) to teach content that is not contextually grounded. When math and science concepts are taught the teacher needs to either teach a new concept

within an existing context or teach the use of an existing concept within a new context. It is when a new concept is taught in a new context that students are at a profound disadvantage.

Knowledge of students applied to learning. Next, teachers must recognize the needs and strengths of students as well as the processes students use to make sense and generalize math and science concepts. Many students derive a correct answer but lack the understanding to elaborate on the relevant concepts and procedures that were involved. Having children show their knowledge in different formats deepens their understanding of the concepts as well as encourages them to integrate the new learning into other content domains. This does not have to lengthen the math or science period but does require the teacher to reorganize the allotted instructional time. The teacher has to establish an environment that is contextual problem solving by nature and less didactic. Students need longer periods of time in class to problem solve with peers, discuss and re-process not only solutions but also the process of finding solutions.

One method that supports student needs involves grouping. Working in pairs or triads provides several benefits for students with diverse abilities. First, students can validate what each understood from the teacher's instruction as well as validate each other's construction of meaning from the activities and problems presented in the classroom situations. By having students work in pairs they share the responsibilities of solving the problem, while noting process thoughts in individual journals, etc. Partners (2-3 member groups work best) are equally responsible for facilitating the learning while larger groups disintegrate into one or two people taking the lead and the other team members passively following (not all that different from teacher lead didactic class instruction). The teacher, based on individual strengths, personalities, cognitive styles, experiential background, etc., should make conscious decisions about how to partner students for maximum learning. Self-selected partners often are based on social strengths and not learning potential.

Students are often insecure when they are learning a new content skill. Teachers must also consider and be aware of the impact of their grading and feedback practices on student achievement and motivation. Traditional grading draws attention to the mistakes a child makes. Use of a bottom-up approach, where marks (+) are put by the items that the student gets correct as he/she earns points shifts the emphasis. Students view their efforts as progress towards a goal instead of just trying to avoid costly mistakes. Mistakes are an impetus for future learning only if the cost of making a mistake is not too high. Many students cannot afford to make mistakes under the current grading systems and hence the teachable moment is lost to arguments, disappointment, anger, etc. over missed points.

Self-awareness. Teachers who are well versed and enjoy teaching, a particular content, typically have a wider variety of approaches to employ in making the content accessible to students. Teachers with a deep understanding of a content can generate a greater variety of approaches as well as applications to the child's real world. Being able to create contextual situations to embed new content skills is a key element in establishing experiences for learning. By using national standards as well as state and local district standards to generate classroom skills the teacher frees himself or herself from limitations of a textbook. By focusing on the skills to be taught a teacher can then decide what tool or tools (manipulatives, computer programs, text material, situational scenario, etc.) are best suited to an individual group of students.

What Can I Use Tomorrow? Content Tips and Strategies:
• When students work in pairs, have one write the problem on the board and the other explain it. This will help the teacher to assess individual students even when working in pairs. • Create a game table/center where all the games used to teach the content skills are available for the students continual use. Students will continually reinforce their math skills and discipline problems will be reduced. • Create a "vocabulary wall" of terms that are commonly used in math and science. Students' vocabulary will be reinforced if they have immediate access to terms. (Avoid using pronouns in the instructional cycle.) • Coordinate homework assignments across grade level/contents to limit the total nightly homework. • Enroll in a class or workshop that focuses on the content area that you feel weakest. • Teach and center instruction around the "Big Ideas." There is considerable content understanding required of students. Interweave concepts such as mathematical principles, place value, number sense, etc. into lessons.

Collaboration

Teachers, whether they are special or general educators, can no longer shut their doors and instruct in isolation. The nature of diverse school populations, growing thrust for integrated curriculum, and increasing numbers of students with identified disabilities require expertise across traditional boundaries (Blalock, 2001; Friend & Cook, 2001). While special educators have traditionally interacted collaboratively in multidisciplinary and individualized education program teams, the type of collaboration required for accessible content delivery and accommodation in math and science curriculum require additional considerations.

First, teachers can draw upon the expertise of one another. When teachers collaboratively pool their individual class activities together from each content area they can construct a menu of options. Burns (2000; 1990) suggests that by providing an environment that includes several options, students can construct knowledge by having several meaningful experiences. The menu concept is based on the idea that teachers construct a one to two page menu of 4-8 activities around one concept. Students select and engage in several options during the course of the class period. Students have the freedom to select the activities they want to engage in which allows them to be vested in the tasks selected. It also allows them to select the learning tasks that best fit their individual learning needs. The activities are contextual in nature as well as diverse, allowing students to have several real world experiences with a mathematical or science concept as part of the instructional process. Teachers are cooperatively creating and sharing content menus so there is a natural cohesion and quality in the learning tasks. Materials can also be pooled to support each menu reducing the overall cost in materials as well as materials and other resources. Moreover, the menu approach provides teachers multiple opportunities to embed specific types of adaptations into instructional materials to support a wide variety of students' strengths and needs.

Teachers also need to utilize effective collaboration strategies. These include such steps as: 1) determining a purpose and time frame for collaboration; 2) discussing strengths knowledge and abilities in content and instructional strategies; 3) planning explicit roles and responsibilities; 4) identifying needs and possible interventions, activities, strategies; 5) brainstorming possible road blocks and solutions; 6) planning curriculum 7) planning modifications; 8) implementing curriculum and modifications and 9) monitoring and evaluating the success of collaboratively delivered curriculum (Blalock, 2001; Friend & Cook, 2000).

Additionally, teachers can incorporate and model collaborative strategies through peer tutoring. Proactive tutoring (Tobias, 1990) is a strategy that has tutors in the classroom to help students comprehend and master a lesson by getting help during the regular classroom instruction. In this way all students are allowed to benefit from the instructional cycle and the tutoring session that often happens outside the regular classroom is grounded in the same instruction as well as manipulatives. Teachers can select students from within the class to peer tutor, call in outside tutors such as parents or students from other grades, or utilize their collaborative teaching partners. The proactive tutoring allows for a reduced ratio and multiple perspectives on a lesson. Peer tutoring has been demonstrated as an effective intervention for students with varying strengths and skills (Mastroprieri & Scruggs, 2000) with benefits both to tutees and tutors. While a number of varying peer tutoring models have been discussed, perhaps the most critical elements of success involve careful training, monitoring and evaluation of the tutoring program. Some considerations include 1) clarify goals and objective of the tutoring program with tutors and tutees; 2) provide tutors and tutees specific goals for the tutoring session(s); 3) select and match tutors carefully, with consideration toward compatibility of partners, 4) train tutors in effective materials and interaction skills; 5) establish and convey procedures and standards for tutoring session; 6) schedule and consistently allow time for tutoring session; and 7) monitor, adjust and evaluate the effectiveness of the tutoring intervention (Mastroprieri & Scruggs, 2000).

What Can I Use Tomorrow? Collaboration Tips and Strategies:
• Challenge another class to a weekly contest. This will promote community within the classroom as they work together to outperform another class. • Create a bank of instructional activities with colleagues on selected math and science topics. Share and expand the menu bank across time. Record successes, challenges, ideas for future use in the "bank." • Develop a collaboration wish list of the types of collaborative activities and supports that would benefit students. Share with other interested individuals in the school. • Start a proactive tutoring partnership with older students, parents, teachers, support personnel, or by matching up students within your classroom.

Strategies for Accessible Math and Science Content

Student Involvement

By the nature of special education, in particularly the Individualized Education Program (IEP), each student is viewed as a person not as an object. This distinction is important as it shifts the focus from planning a successful lesson to planning for the success of students (Lewin, 1999). Students need to be given explanations for the skills and behaviors that are expected of them. In the same way the limitations of the environment and the people within the environment should be a consideration of the teacher as well as all students. Becoming responsible for their own learning begins with realistic expectations, the right to ask questions, the freedom to be an active learner, and quality guidance.

Students need to be encouraged to explore their own strengths and weaknesses. By encouraging students to explore metacognitive thinking styles they develop an understanding for their own strengths and weaknesses (Sternberg, 1997; Gardner, 1993). This understanding facilitates students to develop avenues to take advantage of their strengths when dealing with the different content areas. Teachers love to help students and often modify the lesson or manipulative to better meet the individual needs of students. While this is noble of the teachers it is also handicapping to the student. Students need to be able to apply metacognitive strategies to their daily lives outside the school. So, the focus needs to be on students adapting to meet the learning tasks as well as knowing how to select tools and adapt the learning to their individual strengths effectively. The teacher's role in this process is to expose students to different metacognitive strategies and allow students the freedom to adapt the environment and assignments.

What Can I Use Tomorrow? Strategies and Tips for Student Involvement
• Have students solve 10 story problems with a partner based on the lesson content instead of a set of preformatted problems. Then have them use the concepts from the lesson to create story problems. • Have students create games that utilize the skills. Create a classroom math and/or science trivial pursuit game. As your students master a skill they are given cards to create their own questions to be included in the ever-growing classroom set of question cards. • Have students work the problems out on individual dry-wipe boards or on scrap paper first. Then transfer their work to their journal or assignment paper. This allows them to work freely on the problem first and then organize it for others to follow. • As concepts are experienced in the classroom have students create posters illustrating the concept (visual cues and mathematical cues) with all the appropriate vocabulary (linguistic cues) to be posted in the room. • Have students individually and in groups solve 3-4 story/lab problems that require critical thinking. Then discuss how they solved the problems and analyze what strategies were used. Help students to begin to verbalize their metacognitive strengths and preferences.

Organizational Strategies

The teacher's job is to align the curriculum in such a way that the standards are translated into daily instructional events. The skills outlined by the standards can be quite difficult but they do not have to be mind-boggling. Teachers that are well versed in the content can analyze the skills and present them in the order that makes the most sense to the students in terms of context and ease of cognitive organization. Point in case is the dreaded multiplication facts. Most teachers present them in the 1-9 order but Thornton & Noxon (1977) suggest exposure to the multiplication facts in a 2,5,0,1,9,squares, and then the 10 remaining facts sequence is much less stressful. Constance Kamii (1994) agrees that order of difficulty is an important consideration but instead of teaching 1x1 through 1x9 the sequence is alter to teach 0x0 through 4x4 first. Regardless of the final sequence it should be a conscious teacher made decision, with the students' learning potential in mind, not some arbitrary sequence.

Meaningful integration of content. The use of reality based, story problems that are created for the students as well as the ones created by the students allows for the integration of content that is relevant to the students' lives as part of the lesson. The story problem integration is not only intrinsically more interesting to students but is also integrates literacy, science, language arts, etc. into every lesson. Piaget was critical of the departmentalized education approach as it weakened the inherent integration of subject matters with each other as well as the physical

environment. A prime example was found in a 4th grade math class where students were asked to multiply 25 by 7. All 24 of the students observed began working the problem using the traditional algorithm, which took about 2 minutes for the majority of the students to get an answer. Several days later one of the story problems presented the students with a situation where they needed to find the sum in a piggy bank that contained 7 quarters. Most of the children involved solved the problem in their head or by drawing 7 quarters and grouping 4 as one dollar and 3 as 75 cents. Piaget suggested that if content construction of knowledge is promoted then students will naturally make connections, forging a much deeper understanding of the content (Kamii, 1996).

Presenting content: The work of Gagne (1992) emphasized the difference between planning a lesson and designing an effective instructional sequence. While the two are related it is important for novice teachers or experienced teachers that are novice to a content area to do more in depth planning for the instructional delivery of a lesson. The effective instructional sequence is made up of nine instructional events that may be utilized in the order that is most appropriate for each specific lesson. While order and even repetition of the instructional event may vary it is vital that all nine events are utilized during the instructional sequence. Each of the nine instructional events is briefly summarized below.

- Attention Getting Devise – Devise a variety of ways that are comfortable for you as the teacher and effective in getting your students' attention. The goal is to relate the attention getting device to the lesson that is to be presented so continuity is maintained. Consider the use of cues in math and science to alert students to content.
- Inform the Learner of the Objective – Let the students know what skill will be taught that day and what will be expected from each student at the end of the lesson.
- Recall Prerequisite Learning – If the objective for today requires students to possess pertinent information that information should be quickly reviewed prior to beginning the new lesson.
- Teach the New Content – Provide the students with activities that require the new skill(s) and have them raise questions as they work with the task/skill. Manipulatives should be readily available for use in the instructional, guided practice, and individual phases of the lesson. Students must be actively involved at high rates of participation. Demonstrate and provide a permanent product as needed of the content. Teachers may also embed the use of memory devices such as mnemonics to assist learners in acquiring new content (Mastroprieri & Scruggs, 2000; Miller & Mercer, 1998)
- Group/Guided Practice Note: Students work in groups or as a class with an organized set of problem solving opportunities. By working in groups (pairs preferred) the students get to guide and validate each other's work. (Do not allow students to select a partner. As the teacher you know the strengths and weaknesses of your students and are much more capable of pairing students that will compliment each other on a learning task so, plan ahead.)
- Individual Practice – Since the goal is to get all students to master the skill it is essential that after the guided practice phase each student be given individual opportunities to demonstrate their skills.
- Feedback – The teacher should provide non-judgmental feedback aimed at improving the student's performance. This should be task specific and yet acknowledge effort, ideas, and risk-taking.
- Assessment – This is an ongoing process that helps the instructor and the students monitor the progress that is being made. The major purpose of assessment is to guide the teacher in constructing learning activities for future lessons.
- Retention and Transfer – The goal is to relate the skills that were developed throughout the lesson to the students' lives and real world experiences.

Assessing Content: The purpose of assessment is to help plan the actions that the teacher needs to engage the students in for the current and future lessons (Popham, 2001). There are many ways to glean the information needed to effectively match instruction with student development. Traditionally teachers have used written assignments as the main source of assessment information. However, written assignments are often a day delayed and as such end up being turned immediately before the next lesson is to begin. Tests and written assignments are not always timely given the nature of assessment. Other assessment strategies can provide necessary information if employed in a systematic manner. Observational assessment requires the teacher to interact and observe students actively engaged in a task at hand. These observational notes are then compiled at the end of the period/day to guide how the learning environment will be structured for the following day's lesson. Through observation teachers can utilize performance assessment, authentic engagement, dialogue checks, etc. to assess and document strengths and weaknesses in achievement. Index cards or peel-and-stick address labels can be used to record the documentation

on during the class and then easily be sorted into individual student folders or profile sheets to create a longitudinal record of a child's progress and needs.

What Can I Use Tomorrow? Organizational Tips and Strategies:
• Pass out a set of test items or story problems that have all been worked but contain errors. Have students get together in pairs and find the errors in each problem. • Instead of using horizontal number lines create vertical number lines. Numbers increase as the students count up and decrease as they count down or subtract. This makes physical and contextual sense to students. • Instead of using circles for students to work with in creating fractional representations use graph paper. Circles are difficult to bisect into equal parts. However if the students can create rectangles by tracing the grid lines on graph paper equal parts can be represented easily. • Challenge your students to create a poem, limerick, rap, cartoon, mini-dramas, etc. that make a play on the mathematical terms, content, and/or applications. • Every 12-15 minutes of the class period shift the activity. (i.e. teacher directed learning, partner task, presentation of findings to the class, individual practice, etc.) When one mode or activity is maintained for too long (over 15 min.) students begin to withdraw from active learning.

Literacy Strategies

With the increasing and changing demands for content coverage, textbooks in mathematics and science have changed over the past decade. The information and activities presented in these texts require students typically to have grade level or above reading comprehension skills, to understand complex vocabulary, to use textbook and content level study strategies, and to respond using varying levels of written expression (Schumaker & Lenz, 1999). A number of textbooks provide little review, lack multiple examples to build generalization, and provide little supportive feedback or correction procedures (Polloway, et. al., 2000). Students, therefore, may not be able to key into important terms, relationships, concepts or processes used in textbooks (Miller & Mercer, 1999; Schumaker & Lenz, 1999). They may also experience difficulty following the written directions or responding to the demands requiring written or narrative responses. This means that many students, including some with disabilities remain at a disadvantage. When educators subscribe to a textbook driven approach, these students remain at a loss, unable to access the curriculum.

What Can I Use Tomorrow? Literacy Tips and Strategies:
• Create study guides and outlines (or partially completed outlines) of textbook information. These can be previewed prior to use of a reading selection and reviewed upon completion. • Use graphic organizers in advance of textbook use to cue main ideas and concepts within the chapter. • Preteach and provide vocabulary practice of key terms presented. • Prepare audiotapes of books or selected chapters. Recordings for the Blind and Dyslexic may provide a desired textbook in audiotape format. Plan in advance to obtain the needed material. • Utilize Assistive Technology devices to support writing needs such as voice recognition software or use a low-tech option of tape recording responses.

Rural Considerations

Planning and delivering accessible math and science content in inclusive settings can be an enriching, exhausting, and exciting, prospect for both teachers and students. Maintaining content integrity while providing adaptations that promote successful learning to occur for varied student strengths and abilities is an ongoing process. It requires a desire and enthusiasm for the content, content specific knowledge, pedagogical skills supporting best practices, collaborative partnerships, and supportive organizational and literacy supports. Indeed this is a challenging order to fill. Rural educators, however, also face unique issues. They may incur certain challenges in addressing accessible content. Inadequate or unavailable resources (material, training, and personnel) are one such area. Within smaller communities, special educators may also have few other colleagues in their specific peer role group with whom to share successes and concerns, and with which to brainstorm accessible content solutions. Yet, rural educators are also at an advantage. Rural school communities offer more cohesive groups of parents, teachers,

and community members. These close ties can foster the collaboration process. It is through this type of continued dialogue, shared commitment, and community vision that meaningful accessible content can become a reality for more students.

References

Blalock G. (2001). Strategies for collaboration. In E.A. Polloway, J. R. Patton, & L. Serna, Strategies for teaching learners with special needs (7th ed.). Upper Saddle River, NJ: Merrill.

Burns, M. (2001). About teaching mathematics. Sausalito, CA: Math Solutions, Inc.

Burns, M., & Humphreys, C. (1990). A collection of math lessons from grades 6 through 8. Sausalito, CA: Math Solutions, Inc.

CBMS (2001). Mathematical education of teachers. In Issues in Mathematical Education: Vol. 11.

Elliot, J. L., & Thurlow, M. L. (2000). Improving the test performance of students with disabilities... on district and state assessments. Thousand Oaks, CA: Corwin Press.

Friend, M. & Cook, L. (2000). Interactions: Collaboration skills for school professionals (3rd ed.). NY: Longman.

Gagne, R.M., & Driscoll, M.P. (1988). Essentials of teaching. Englewood Cliffs, NJ: Prentice Hall.

Gardner, H. (1993). Multiple intelligences: The theory in practice. New York: Basic Books.

Ginot, H. (1972). Between teacher & child. New York: Avon.

Hitotsumatsu, S., (1998). First grade mathematics. Numazu: Gakko Tosho Kabushikigaisha.

Hollander, S.K. (1988). Teaching learning disabled students to read mathematics. School Science and mathematics 88(6), p.509-15.

Jones, E. D., Wilson, R., & Bhojwani, S. (1998). Mathematics instruction for secondary students with learning disabilities. In D. P Rivera (Ed.). Mathematics education for students with learning disabilities: Theory to practice (pp. 155-176). Austin: Pro-Ed.

Kame'enui, E. J., Carnine, D. W., Dixon, R. C., Simmons, D.C., & Coyne, M. C. (2002). Effective teaching strategies that accommodate diverse learners (2nd ed.). Upper Saddle River, NJ: Merrill.

Kamii, C. (1994). Young children continue to reinvent arithmetic 3rd grade: Implications of Piaget's theory. New York, NY: Teacher's College Press, Columbia University.

Kohn, A. (2000). A case against standardized testing: Raising the scores, ruining the schools. Portsmouth, NH: Heinemann.

Lewin, K. (1999). Democracy in the school. In M. Gold (Ed.), The complete social scientist. (pp. 321-325) Washington, D.C.: American Psychological Association.

Locke, J. (1693). Some thoughts concerning education. In P.Gay (Ed.), John Locke on education. NY, NY: Teacher's College Press, Columbia University, 1964.

Mastroprieri, M. A., & Scruggs, T. E. (2000). The inclusive classroom: Strategies for effective instruction. Upper Saddle River, NJ: Merrill.

Miller, S. P., & Mercer, C. D. (1998). Educational aspects of mathematics disabilities. In D. P. Rivera (Ed.). Mathematics education for students with learning disabilities: Theory to practice. Austin, TX: Pro-Ed.

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: NCTM.

Ormsbee, C. K., & Finson, K. D. (2000). Modifying science activities and materials to enhance instruction for students with learning and behavior problems. Intervention in School and Clinic, 36(1), 10-21.

Parmar, R. S., & Cawley, J. F. (1998). Preparing teachers to teach mathematics to students with learning disabilities. In D. P. Rivera (Ed.). Mathematics education for students with learning disabilities. (pp. 219-236). Austin, TX: Pro-Ed.

Popham, W. J. (2000a). Modern educational measurement: Practical guidelines. Boston, MA: Allyn & Bacon.

Popham, W. J. (2000b). Testing! Testing!: What every parent should know about tests. Boston, MA: Allyn & Bacon.

Popham, W.J. (1997). Classroom assessment: What teachers really need to know. Boston, MA: Allyn & Bacon.

Schmidt, M. W., & Harriman, N. E. (1998). Teaching strategies for inclusive classrooms: Schools, students, strategies and success. Fort Worth, TX: Harcourt Brace Jovanovich.

Schumaker, J., & Lenz, K. (1999). Adapting language arts, social studies, and science materials for the inclusive classroom. ERIC/OSEP Mini-Library: Adapting curricular materials. Volume. 3: Grades six through eight. Reston, VA: The Council for Exceptional Children.

Schumm, J. S. (1999). Adapting reading and math materials for the inclusive classroom. ERIC/OSEP Mini-Library: Adapting curricular materials. Volume. 2: Kindergarten through grade five. . Reston, VA: The Council for Exceptional Children.

Sherwood, J.J. (1965). "A relation between arousal and performance." American Journal of Psychology, 78, 461-5.

Sternberg, R.J. (1997). Thinking styles. NY, NY: Cambridge University Press.

Thornton, C.A., & Noxon, C. (1977). Look into the facts: Multiplication and division. Palo Alto, CA: Creative Pub.

Tobias, R. (1990). Nurturing at-risk youth in math and science: Curriculum and teaching considerations. Bloomington, IN: National Educational Service.

Tucker, B., Singleton, A.H., & Weaver, T.L. (2002). Teaching mathematics to all children. Upper Saddle River, NJ: Merrill Prentice-Hall.

Tracy, D.M. & Hague, M.S. (1997). "Toys 'r' math." Mathematics: Teaching in the Middle School, 2(3), 140-145,159.

U.S. Department of Education (2000). Twenty-second annual report to Congress on the implementation of the Individuals with Disabilities Education Act. Washington, DC: U.S. Government Printing Office.

Weiss, I. R. (1994). A Profile of Science and Mathematics Education in the United States: 1993. Chapel Hill, NC: Horizon Research, Inc.

To: Velma Mitchell
304-347-0467

U.S. Department of Education
Office of Educational Research and Improvement
(OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

ERIC

Reproduction Release
(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: American Council on Rural Special Education 2002 Conference Proceedings No Child Left Behind: The Vital Role of Rural Schools	
Author(s): multiple	
Corporate Source:	Publication Date: 3-1-02

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, Resources in Education (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign in the indicated space following.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY SAMPLE TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY SAMPLE TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY SAMPLE TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
Level 1	Level 2A	Level 2B
☒	☐	☐
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g. electronic) *and* paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche onl

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche, or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Signature:	Printed Name/Position/Title:	
Judy Weyrauch	Judy Weyrauch / Headquarters Manager	
Organization/Address: American Council on Rural Special Education 2323 Anderson Ave. Ste 226 Manhattan KS 66502-2912	Telephone: 785-532-2737	Fax: 785-532-7732
	E-mail Address: acres@ksu.edu	Date: 4-9-02

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

Acquisitions
ERIC/CRESS at AEL
P. O. Box 1348
Charleston, WV 25325-1348
Toll Free: 800-624-9120
FAX: 304-347-0467
e-mail: ericrc@ael.org
WWW: http://www.ael.org/eric/

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the